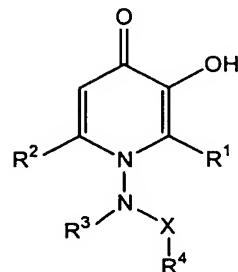


CLAIMS:

What is claimed is:

1. An N-substituted 3-hydroxy-4-pyridinone compound of the formula (I):

5



(I)

or a pharmaceutically acceptable salt thereof, or prodrug thereof, wherein:

- 10 X is selected from the group: CH₂, C(O), C(S), P(O)R³R⁴, SO₂, C(=NH)NH, C(O)NH, and C(S)NH;
- 15 R¹ and R² are independently selected from: H, C₁-C₁₀ alkyl substituted with 0-5 R⁵, C₂-C₁₀ alkenyl substituted with 0-5 R⁵, aryl substituted with 0-3 R⁵, and heteroaryl substituted with 0-3 R⁵;
- 20 R³ and R⁴ are independently selected from: C₁-C₁₀ alkyl substituted with 0-5 R⁵, C₂-C₁₀ alkenyl substituted with 0-5 R⁵, aryl substituted with 0-3 R⁵, heteroaryl substituted with 0-3 R⁵, or R³ and R⁴ may be taken together to form a C₅-C₇ cyclic alkyl group optionally interrupted with O or NR⁶;
- 25 R⁵ is selected from: OH, C(=O)R⁶, C(=O)OR⁶, C(=O)NR⁶R⁷, PO(OR⁶)(OR⁷), S(O)₂OR⁶;
- R⁶ and R⁷ are independently selected from: H, C₁-C₁₀ alkyl, or aryl.

2. The N-substituted 3-hydroxy-4-pyridinone compound according to claim 1 wherein:

X is selected from the group: CH₂, C(O), and SO₂;

R¹ and R² are independently selected from: H, C₁-C₃ alkyl substituted with 0-2 R⁵, and C₂-C₃ alkenyl substituted with 0-2 R⁵;

5 R³ and R⁴ are independently selected from: C₁-C₆ alkyl substituted with 0-3 R⁵, C₂-C₆ alkenyl substituted with 0-3 R⁵, aryl substituted with 0-3 R⁵, heteroaryl substituted with 0-3 R⁵, or R³ and R⁴ may be taken together to form a C₅-C₇ cyclic alkyl group optionally interrupted with O or NR⁶;

10 R⁵ is elected from: OH, C(=O)OH, and C(=O)NR⁶R⁷;

 R⁶ and R⁷ are independently selected from: H and C₁-C₆ alkyl.

3. The N-substituted 3-hydroxy-4-pyridinone compound according to claim 1 wherein:

15 X is selected from the group CH₂, C(O), and SO₂;

 R¹ is H;

 R² is methyl or ethyl group;

20 R³ and R⁴ are independently selected from: aryl, heteroaryl, or R³ and R⁴ may be taken together form a 5-7 membered cyclic alkyl.

4. The N-substituted 3-hydroxy-4-pyridinone compound according to claim 1 wherein:

 X is CH₂;

 R¹ is H;

25 R² is methyl;

 R³ and R⁴ are taken together form a 6-membered cyclic piperidine ring.

5. The N-substituted 3-hydroxy-4-pyridinone compound according to claim 1 wherein:

30 X is CH₂;

 R¹ is H;

 R² is methyl;

R³ and R⁴ are taken together form a 6-membered cyclic morphine ring.

6. The N-substituted 3-hydroxy-4-pyridinone compound according to claim 1 wherein:

5 X is CH₂;

R¹ is H;

R² is ethyl;

R³ and R⁴ are taken together form a 6-membered cyclic morphine ring.

10 7. The N-substituted 3-hydroxy-4-pyridinone compound according to claim 1 wherein:

X is C(O);

R¹ is H;

R² is methyl;

15 R³ is H;

R⁴ is phenyl.

8. The N-substituted 3-hydroxy-4-pyridinone compound according to claim 1 wherein:

X is C(O);

20 R¹ is H;

R² is ethyl;

R³ is H;

R⁴ is phenyl.

9. The N-substituted 3-hydroxy-4-pyridinone compound according to claim 1 wherein:

X is C(O);

R¹ is H;

R² is methyl;

R³ is H;

30 R⁴ is 3-pyridine.

10. The N-substituted 3-hydroxy-4-pyridinone compound according to claim 1 wherein:

X is C(O);

R¹ is H;

5 R² is methyl;

R³ is H;

R⁴ is 4-pyridine.

11. The N-substituted 3-hydroxy-4-pyridinone compound according to claim 1 wherein:

10 X is C(O);

R¹ is H;

R² is ethyl;

R³ is H;

R⁴ is 2-thiophene.

15 12. The N-substituted 3-hydroxy-4-pyridinone compound according to claim 1 wherein:

X is SO₂;

R¹ is H;

R² is methyl;

20 R³ is H;

R⁴ is phenyl.

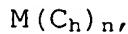
13. A method for the preparation of an N-substituted 3-hydroxy-4-pyridinone compound according to claim 1.

25 14. A pharmaceutical composition comprising a therapeutic effective amount of an N-substituted 3-hydroxy-4-pyridinone according to claim 1 for the treatment of iron overload.

30 15. A pharmaceutical composition comprising a therapeutic effective amount of an N-substituted 3-hydroxy-4-pyridinone compound according to claim 1 and a

therapeutic metal for the treatment of diseases, such as parasitic and viral infections, conditions associated with inflammation and infection, and conditions mediated by collagen formation.

5 16. A radiopharmaceutical of the formula:



and pharmaceutically acceptable salt thereof, wherein:

M is a radionuclide selected from: ^{64}Cu , ^{67}Cu , ^{67}Ga ,
 ^{68}Ga , ^{99m}Tc , ^{111}In , ^{90}Y , ^{149}Pr , ^{153}Sm , ^{159}Gd , ^{166}Ho , ^{169}Yb ,
10 ^{177}Lu , ^{186}Re , and ^{188}Re ;

n is 2 or 3;

X is CH_2 ;

R^1 is H;

R^2 is methyl;

15 R^3 and R^4 are taken together form a 6-membered cyclic piperidine ring.

17. The radiopharmaceutical according to claim 16 wherein:

M is a radionuclide selected from: ^{67}Ga , ^{68}Ga , ^{99m}Tc ,
20 and ^{111}In ;

n is 3.

18. The radiopharmaceutical according to claim 16 wherein:

M is ^{111}In ;

25 n is 3.

19. The radiopharmaceutical according to claim 16 wherein:

M is ^{111}In ;

n is 3;

30 X is CH_2 ;

R^1 is H;

R² is methyl;

R³ and R⁴ are taken together form a 6-membered cyclic piperidine ring.

20. The radiopharmaceutical according to claim 16
5 wherein:

M is ¹¹¹In;

n is 3;

X is CH₂;

R¹ is H;

10 R² is methyl;

R³ and R⁴ are taken together form a 6-membered cyclic morphine ring.

21. An MRI contrast agent of the formula:

M(C_h)_n,

15 and pharmaceutically acceptable salt thereof, wherein:

M is a paramagnetic metal ion of atomic number 21-29, 42-44, or 58-70;

n is 2 or 3;

20 C_h is an N-substituted 3-hydroxy-4-pyridinone according to claim 1.

22. The MRI contrast agent according to claim 21 wherein:

M is selected from: Fe³⁺ and Mn²⁺ and Gd³⁺;

n is 2 or 3;

25 C_h is an N-substituted 3-hydroxy-4-pyridinone according to claim 1.

23. The MRI contrast agent according to claim 21 wherein:

M is Fe³⁺ and Mn²⁺;

30 n is 2 or 3;

C_h is an N-substituted 3-hydroxy-4-pyridinone according to claim 1.

24. The MRI contrast agent according to claim 21 wherein:

5 M is Fe^{3+} ;

n is 3;

C_h is an N-substituted 3-hydroxy-4-pyridinone according to claim 1.

25. A method of preparing a radiopharmaceutical of
10 claim 16.

26. A method of preparing an MRI contrast agent of
claim 21.

27. A pharmaceutical composition comprising a metal chelate of the formula:

15 $M(C_h)_n$,

and pharmaceutically acceptable salt thereof, wherein:

M is a metal ion or a metal-containing core selected from: Ca^{2+} , Sn^{2+} , Cu^{2+} , Zn^{2+} , V^{3+} , $V^{5+}(O)$, or $V^{5+}(O)-O-V^{5+}(O)$;

20 n is 2 or 3;

C_h is an N-substituted 3-hydroxy-4-pyridinone according to claim 1.

27. A method of treating of a disease such as viral infections, conditions associated with inflammation and
25 infection, and conditions mediated by cell-proliferation or collagen formation, comprising administering a patient in need of such treatment a therapeutically effective amount of a pharmaceutical composition according to claim 26.